DENISON UNIVERSITY BULLETIN

Volume 49, No. 5

JOURNAL

OF THE

SCIENTIFIC LABORATORIES

Volume 42 **Articles 1–3** **Pages 1 to 19**

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GRANVILLE, OHIO

APRIL, 1950

The Denison University Bulletin is published bi-monthly and entered as second class mail matter at the Post Office at Granville, Ohio, under Act of August 24, 1912.

JOURNAL OF THE SCIENTIFIC LABORATORIES OF DENISON UNIVERSITY

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FOOD, AGRICULTURE AND HEALTH[1]

One can be either exalted or depressed by looking at current pictures of the world of tomorrow. The two conditions presented most often by the public press are: first, warfare so intense that civilization will be utterly destroyed; or, second, a fate that would be worse than the first, a slow and inescapable starvation resulting from increased population without comparable increases in available food.

Others look at the same evidence and the same problems and arrive at a very different appraisal. They make life worth living, with a ray of hope for an intelligent, Christian world in which free men, with a high sense of public trust will seek to analyze the problems as they arise and then press forward to solve them.

Vannevar Bush, for example, apprises the risks of war in his latest book, and reaches a viewpoint that is decidedly hopeful, based on the premise, of course, that as a nation we are going to be diligent in our efforts to safeguard personal integrity, protect a democratic order in our society, and hold a lead position in exploratory and applied research.

We have a similar opportunity in regard to food. World starvation is not inevitable, and if we can solve that problem, we may, by so doing, go far toward preventing war. President Eisenhower recently stated this thesis as follows: "It is idle to talk about world peace in terms of any kind of values when people are so hungry that they are ready to violate any ethics and commit any crime in order to feed themselves and their families."

Those who did not know the Scottish farmer and physician, Lord Boyd-Orr, were surprised when he received the Nobel Peace Prize in 1949. His friends, however, were not surprised. They had known him through the years as a man with great determination to bring agriculture and the science of nutrition into greater service to mankind, so that one of the prerequisites to building a world without war might be at hand.

After practicing medicine for a time, he became convinced that people in the cities and in the countryside about him needed more of the so-called simple things in life to protect their health. They needed good food in their homes and in their factories. They needed productive farms instead of worn-out soil. So, leaving the practice of medicine, he joined forces with a research and educational group in Aberdeen for a long campaign that is still in its infancy.

A farsighted drive *is* developing throughout the world to rid mankind of the

[1] An address by Dr. Charles Glen King, Professor of Chemistry at Columbia University, and Scientific Director, The Nutrition Foundation, Inc., New York City.

Presented at Denison University on April 13, 1950, under the auspices of the Denison Scientific Association, as the *Clarence Luther Herrick Memorial Science Lecture.*

degenerative forms of poverty and disease. There is hope and common sense in such a program, even though the goal may seem far down the field.

Rational development of natural resources begins with husbanding the soil to provide what men need for decent living. The residents of Chicago, Calcutta and Hong Kong alike are faced with the same inescapable need for food—good food, both in the sense of protecting health and in the sense of meeting the demands of personal enjoyment and world trade.

If the present population of the world could reach the nutritive level of food consumption that is now attained by the best nourished one-fourth of the American population, higher standards of living would be at hand in all sections of the world and for all economic and social strata in each area. Even here, in the United States, where success in food production is a matter of justifiable national pride, there would almost certainly be an extension of ten years or more in the adult period of vigorous living.

No one need lose in such an advance; but the relative gains would be greatest, obviously, in such countries as the Philippines, China, India, Africa, and large sections of Latin America. No greater contribution could we extend to those countries, within the reach of a sound economy in our own country, than to supply leadership in terms of men and basic knowledge with which to solve their respective problems. At the same time we would be improving our own standards of health and living, with a gain rather than a loss in our economic position.

The universities and colleges have a responsibility in this area that we should not underestimate. Men trained in chemistry, biology, medicine, agriculture, economics and engineering, men who have character and the qualities of leadership as well as knowledge and skill, will be needed in increasing numbers just to carry forward new applications of knowledge already at hand. But that it is not enough.

A second and more difficult role of the university lies in the field of exploratory research. Experience makes it clear that each advance in understanding the nature of food—how it grows from the soil, how it functions in our bodies or in the bodies of experimental animals—all this becomes useful in a surprisingly short time. For example, Pasteur's discovery of some of the steps by which yeast cells produced alcohol in making French wine stimulated the British chemist, Hopkins, to find similar reactions in the tissues of animals. And then Hopkins went on to discover that animals and man needed a new group of substances, the vitamins, in their food supply in addition to proteins, minerals, sugars and fats. The German scientist, Warburg, built upon these early leads to discover some of the earliest known peculiarities of cancer cells, and continuing, opened up new approaches to understanding photosynthesis.The latter is, of course, the primary basis of plant growth and furnishes the origin of all foods. By application of Pasteur's discovery to the protection of modern milk supplies in so-called pasteurization, many thousands of American residents each year derive their chance to live; and dairy farming has become one of our greatest economic assets.

The Canadian scientists, Banting and Best, gave mankind a measure of

practical control over diabetes by finding that the burning of sugars and fats could be regulated, first in dogs and then in children, by supplying a hormone, insulin, extracted from animal by-products at the slaughter house. However, we, today, should note that the cause or causes of diabetes and its fellow travelers, hardening of the arteries, cerebral hemorrhage, high blood pressure, heart failure and occasionally blindness, still baffle the medical profession. The science of nutrition is bringing light into these and other areas; but it is still in its infancy in the sense of preventive medicine, or protection of health before diseases appear.

When scientists first began to realize how complex our food supply must be to permit growth and to sustain health, they naturally turned their attention to discovering what is in such foods as milk, fruit, whole grains, meat, eggs and green leaves. The total number of known essential nutrients now reaches to about 45.

It is less than a year, however, since Professor Rose of the University of Illinois reported his discovery of the protein fragments in meat and milk that must be present in human foods to protect health. Yet this discovery is the key to evaluating the most expensive items in the world's food supply—the so-called animal protein foods.

And in each of the last two years, new vitamins were isolated from foods known originally as excellent sources of protein. It is not surprising that the vitamins were immediately useful in curing such common human ailments as anemia, stunted growth, certain nerve diseases and infections. Actually the sequence of discovering a new vitamin because it is needed by a rat, chicken or guinea pig and then, that the same vitamin is necessary to protect human health, has been almost an annual experience for 18 years—since 1932.

Success in developing an attractive and reliable source of vitamin C in the form of frozen, concentrated orange juice has shot from a pilot plant scale to within the range of 500 million cans per year, within four years. In a practical sense, it revolutionized and salvaged the citrus industry in Florida, almost at once. In 1950 about one-third of the entire Florida crop will be marketed in the new form.

At Purdue University, as a result of systematic cross-breeding from primitive varieties of tomatoes, they expect to start distributing within two years, a new commercial variety of tomatoes that will have a vitamin C content equal to oranges and a vitamin A content high enough to meet the entire nation's requirement at present levels of consumption.

While we are discussing recent returns from basic understanding of genetic research, one should mention the rapid growth of the dairy industry in the deep south, accomplished in part by cross-breeding of Jersey stock with Brahmin stock from India, to secure a new variety of animal, with combined laurels from both parents, namely, good milk production plus a rugged tolerance of the subtropical environment.

American citizens have reason to be proud of their record food exports to Western Europe during and after World War II. We recognize that the food

pipeline was essential to victory and a major factor in stabilizing many sections of Europe after the war. But we are not always aware of the fact that our increased farm yield from hybrid corn, alone, during those years was about equal to our total food shipments.

During the past month, the Department of Agriculture has released such figures as these:

(1) The average yield of corn per acre in seven Southern states has increased 50% within the past four years—namely from 16 Bu./acre in 1944 to 25 Bu./acre in 1948.

(2) More than 55,000 farmers produced an average yield of 70 Bu./acre—and they expect to reach an average of 50 Bu./acre for the entire area by 1960—doubling the 1948 yield.

(3) More than 8000 farmers have already qualified for their 100 Bu./acre club.

From such results, the standards of living will rise proportionately. They can afford better schools, the children will have more milk to drink, and they will buy more farm equipment, pottery and automobile tires from other areas such as adjacent cities in Ohio. They might want to send more students to Denison.

Dramatic portrayals of the risks to human health that result from soil deficiencies in trace mineral elements make good stories and press headlines, but generally they have frail support in factual evidence.

A good case can be made for the economic and social necessity of maintaining productive soil, whether based on trace elements, conservation or straight-line fertilizers to secure good crops. Poverty breeds social decay, and poor health results as part of the process.

Only in two instances is there clear evidence of a direct and widespread correlation between trace element soil deficiencies and poor human health in the United States.

The first and *most serious example is iodine.* A large fraction of the total U. S. area has so little iodine in the soil, water and food supply that deficiencies give rise to enlargement of the thyroid gland, or goitre. A practical corrective measure has been introduced in the form of iodized salt, but the consumer is left free to use non-iodized salt, so the protection is not adequate. If pure salt were labeled "goitre-producing," or had some other form of warning label I suppose we would make more progress.

The *second* example is more recent, less serious, and still in the exploratory stages of finding a practical correction—it pertains to fluorine. In areas where the fluoride content of the soil is so low that the drinking water picks up less than one part per million, the incidence of tooth decay is higher than in areas where the fluoride content of the water is higher. The most popular corrective measure is to add fluoride to the public water supply. Preliminary reports of the benefits to children's teeth are encouraging, but obviously such a procedure does not offer any protection except in large city areas.

It is true that there are a great many local areas where the content of other

trace minerals in the soil will not permit good crop production. Deficiencies of zinc, copper, manganese, boron, molybdenum and cobalt are well known. Crops and livestock may show the effects. In no cases, however, so far as I have found, has there been evidence that reaches the point of showing a direct effect upon human deficiency and breaks in health in the same areas. There is so much transfer of food from one area to another, that the localized human risk apparently is small.

One cannot say categorically that human deficiencies of this nature never occur, but one should be at least reticent enough to recognize that such claims have never been supported by evidence. We should continue to explore the risks, to be sure, but not declare them as a fact prematurely.

If we turn for a moment to the question of longevity and health among adults, the most serious diseases beyond cancer would include a vaguely related group closely associated with distortions of normal glandular balances—namely, arthritis, diabetes, arteriosclerosis, heart disease, and high blood pressure. There is no reason to associate any of these diseases directly with the composition of the soil. The fact is, no one knows the common etiology (cause or causes) of any disease in the group. Nevertheless, they are all subject to influence by medical supervision of the patient's food intake, and there is no doubt concerning the fact that good nutrition (often the reverse of over-eating) can do much to prevent their occurrence.

In conclusion, students of world population trends tell us that in 1949 there were about 2,380,000,000 people in all the world, and that the rate of increase would probably continue for a time, at slightly less than 1 per cent per year. By the year 2000, which is not far away, there will be roughly 1.5 billion more people to feed.

In all the under-developed areas together the average income per person is under $100 per year—less than $\frac{1}{12}$ of the average figure for the United States. One baby in five dies before reaching the second year in those areas, and the average life span is less than 30 years, roughly half the value we enjoy.

I agree that their problem is more staggering than ours, and that their lot is going to involve a bitter struggle for survival during the next 50 to 100 years. By that time however, if we can prevent another world war, or continued wars, I believe developments in agriculture, industry and education can meet the most critical needs for decent standards of living. The world's population will then be in a position to build the kind of a world that reflects a reasonable measure of our ideals.

UNIDENTIFIED FACTORS IN WHEAT GERM OIL INFLUENCING REPRODUCTION (A PRELIMINARY REPORT)[1]

EZRA LEVIN, WYNNE SILBERNAGEL, AND FRED A. NICHOLS

EXPERIMENTAL PROCEDURE

The experiment was planned by two of us (E. L. and W. S.) and carried out by F. A. N. at Denison University, Granville, Ohio, under the direction of Dr. A. W. Lindsey.

Various studies (1, 2, 3) have indicated that deterioration of feed constituents affects reproduction adversely. In planning repetition and extension of these studies, we were unable to find records of reproductive performance in rats on a good natural diet with an adequate level of constituents of high biologic quality, known to be "fresh," and not subjected to deterioration.

To provide such a diet, the common casein, dextrin basal diet was supplemented with defatted liver,[2] defatted wheat germ,[2] and defatted whole bovine blood[2] (Table I).

This defatted diet, maintained in a dry atmosphere, would be expected to remain at a constant stability.

Because of our interest in the unidentified factors in wheat germ oil (4, 5), the experiment was planned as follows:

The control group received ½ cc daily of the following; 1000 cc corn oil, 2.5 grams alpha tocopherol, 1 gram distilled vitamin A esters, 0.25 gram calciferol.

The experimental group received ½ cc daily of the following; 1000 cc wheat germ oil[3] containing approximately 2.5 grams alpha tocopherol, 1 gram distilled vitamin A esters, 0.25 gram calciferol. The lipid supplement was administered orally by hypodermic syringe. Analysis of the corn oil and wheat germ oil when the experiment was completed showed no change in peroxides or free fatty acids. They were fed commercial rabbit pellets (Glidden) obtained at a local feed store. Of the young born and weaned at 21 days, two groups of female litter

[1] The work here reported was completed in early 1948 and was withheld from publication until this time, April 1950, to allow a more effective evaluation of the unidentified factors in wheat germ oil.

At the June meetings of the Association for the Study of Internal Secretions, in San Francisco, a series of studies is to be reported by Ezra Levin and John F. Burns, designed to prove the presence of androgenic, progestational, estrogenic and hypophyseal factors in wheat germ oil.

Those studies, and also more detailed studies of the influence of wheat germ oil in the control of abortion in humans, by Dr. Wynne Silbernagel and Dr. James Patterson, Columbus, Ohio, have given strong confirmation of this original study made at Denison University.

THE AUTHORS

[2] Made by the VioBin Corporation, processed at 75°C.

[3] Made by the VioBin Corporation, solvent extracted with ethylene dichloride.

mates were chosen, eight in each group. All males received the experimental diet, care being taken to prevent the oil supplement from smearing around the mouth, or on the coat.

TABLE I

Basal diet

Dextrin	60.0%	
Casein	13.4	
Wheat germ, defatted*	5.7	(37% protein)
Blood, defatted*	4.1	(85% protein)
Liver, defatted*	2.9	(70% protein)
Dextrose	3.8	
Salt mixture	5.3	
68.1 Calcium Carbonate		
22.8 Potassium Phosphate Monobasic		
9.1 Iodized Salt		
Ether Extract	0.2	

* See footnote 2.

TABLE II

Summary of data

	AVERAGE BIRTH WEIGHT	AVERAGE WEANING WEIGHT, 21 DAYS	NUMBER IN LITTER	DEATHS
Experimental Animals				
	grams	*grams*		
K-1	5.6	22.8	14	0
K-2	5.6	23.6	14	0
K-3	5.9	24.2	11	0
K-4	5.8	23.9	12	0
K-5	5.9	23.5	12	1
K-6	5.7	23.9	13	0
K-7	5.8	23.3	12	0
K-8	5.9	23.5	10	0
Control Animals				
I-1	Did not conceive			
I-2	5.0	20.4	10	0
I-3	Did not conceive			
I-4	5.1	19.3	8	3
I-5	5.4	19.2	9	0
I-6	5.1	19.4	10	0
I-7	5.1	19.9	9	0
I-8	Did not conceive			

During the experiment, the males were alternated between the two groups of females. A male was mated with a female for a period of one week then alternated so that the male, that was mated with experimental female No. 1, was mated

with control female No. 2, and vice versa, until animals were pregnant. The control animals had difficulty in conceiving. In view of the importance of this

TABLE III

Individual data

EXPERIMENTAL								CONTROL							
K-1	K-2	K-3	K-4	K-5	K-6	K-7	K-8	I-1	I-2	I-3	I-4	I-5	I-6	I-7	I-8
Litter Number															
14	14	11	12	12	13	12	10	—	10	—	8	9	10	9	—
Birth Weights															
5.7	5.7	5.8	5.8	5.6	5.7	5.9	5.7	Did not conceive	4.7	Did not conceive	4.8	5.4	5.6	5.1	Did not conceive
5.8	5.7	6.2	5.6	5.6	5.8	5.5	6.2		5.3		5.2	5.3	5.2	4.9	
5.6	5.4	6.1	5.9	6.0	5.6	5.6	6.0		5.4		5.5	4.9	4.8	4.9	
5.7	5.6	5.7	6.1	6.0	5.5	5.5	6.1		5.1		5.7	4.7	4.7	5.3	
5.4	5.5	5.8	5.8	6.8	5.9	5.8	5.7		5.3		4.9	4.5	5.4	5.0	
5.6	5.8	5.6	5.5	6.1	5.8	5.9	5.8		4.9		5.4	5.0	5.2	5.4	
5.5	5.5	6.2	5.9	5.7	5.7	6.0	5.9		5.2		5.3	5.1	4.8	5.3	
5.8	5.4	6.0	5.8	5.6	5.6	5.9	5.9		4.7		5.2	5.2	5.4	5.1	
5.7	5.7	6.1	5.9	5.9	5.7	5.8	6.0		4.8		—	4.6	5.2	4.9	
5.6	5.6	5.9	5.5	5.7	5.8	5.8	6.1		4.9		—	—	4.7	—	
5.4	5.8	5.8	5.7	5.8	5.9	5.9	—		—		—	—	—	—	
5.6	5.7	—	5.9	6.0	5.8	6.0	—		—		—	—	—	—	
5.7	5.6	—	—	—	5.7	—	—		—		—	—	—	—	
5.8	5.6	—	—	—	—	—	—		—		—	—	—	—	
Weaning Weights, 21 days after birth															
23.0	21.9	23.6	23.8	23.7	23.7	23.2	23.7	Did not conceive	21.7	Did not conceive	19.5	17.5	20.4	18.2	Did not conceive
21.9	23.8	24.4	23.9	22.2	23.6	23.6	24.3		20.3		20.2	16.2	21.5	18.9	
21.4	22.4	22.9	24.1	23.9	23.9	27.0	24.1		20.4		18.7	20.6	20.1	20.3	
24.5	23.7	24.8	24.3	22.5	24.3	22.8	23.9		21.2		18.9	20.4	18.7	21.4	
23.3	23.4	24.6	23.8	23.1	24.1	23.4	22.9		20.6		19.3	17.9	16.4	20.6	
23.5	23.7	24.3	23.6	24.5	23.4	23.2	22.6		19.6		—	18.4	21.2	19.6	
21.8	23.6	23.9	23.8	24.7	23.5	23.0	23.6		19.6		—	20.1	17.3	19.8	
23.6	23.7	24.6	24.2	24.2	24.4	23.5	23.8		20.2		—	20.6	19.7	20.7	
22.9	23.5	24.3	24.0	24.0	24.3	23.1	22.9		20.5		—	20.5	18.9	19.6	
22.4	23.6	24.7	24.3	23.6	23.9	23.7	23.4		19.4		—	—	20.3	—	
22.4	23.7	24.5	23.9	23.4	23.6	23.4	—		—		—	—	—	—	
22.7	23.8	—	23.8	—	23.7	23.7	—		—		—	—	—	—	
23.2	23.6	—	—	—	23.9	—	—		—		—	—	—	—	
22.6	23.8	—	—	—	—	—	—		—		—	—	—	—	
				one animal died							three animals died				

Statistical evaluation of TABLE III

	EXPERIMENTAL GROUP	CONTROL GROUP
Average birth weight (g)	5.77	5.15
Standard deviation	0.21	0.30
Coefficient of variation (%)	3.6	5.8
Standard deviation of mean difference	0.29*	
Average weaning weight (g)	23.6	19.7
Standard deviation	0.77	1.28
Coefficient of variation (%)	3.3	6.5
Standard deviation of mean difference	1.49*	

* Indicates significant difference at the 5% level.

finding, the male mated with the paired experimental female which had conceived was mated with control animal which did not conceive.

All experimental animals conceived at once. Two controls conceived at once; three controls did not conceive although the male was mated with the female throughout the experiment. Three of the controls did not conceive during the first week, but conceived after being mated with the male for more than a week.

DISCUSSION

1. All eight experimental animals and two controls conceived at once after mating. Three controls were delayed in conceiving. Three control animals failed to conceive. Failure to conceive cannot be due to the lack of alpha tocopherol. Adequate alpha tocopherol was available in the control diet. It should be noted that refined corn oil itself contains a sufficient amount of the tocopherols so that it cannot be used in experimental rations involving vitamin E deficiency. Moreover, the deficiency of alpha tocopherol is not usually reflected in failure of conception, but rather in resorption after conception. The results of this experiment point to the possibility of an unidentified fat soluble factor which influences conception.

2. The lack of this factor or some other factor in the control diet, and present in the experimental diet, was responsible for the difference in birth weights; an average birth weight of 5.77 grams in 98 experimental animals as compared to an average birth weight of 5.15 grams in 46 control animals.

A study of the records of individual weights establishes that the difference is statistically significant.

3. It is usual to find that large litters reveal smaller individual birth weights. The opposite fact, as found in this experiment, is an unexpected result. Although the average birth weight of the experimental group was approximately 10% higher than the average birth weight of the control animals, the average of the litter numbers of the experimental animals was also 25% higher than the average of the litter numbers of the control animals. Statistical evaluation and detailed study of the individual weights (table III) accentuates these figures.

4. Noteworthy is the uniformity of the birth weights of all the experimental litters as compared with the wider variation of the birth weights of the controls. Moreover, comparing K-8, I-2 and I-6 (all litters of ten), we find the average birth weight of K-8 (5.92) I-2 (5.03) I-6 (5.1) revealing a wider difference between the experimental litters and the control litters than the difference of total birth weight averages. There is a consistent uniformity in the weaning weights of all the experimental litters when compared with the wider variation of the weaning weights of the control litters. However, the average weaning weights of litters K-8 (23.52) I-2 (20.35) and I-6 (19.45) does not reveal any greater difference than the total weaning weight averages of the experimental animals as compared with the controls.

5. The average litter number of the experimental group was 12.25. Notwithstanding the retention of an average of 12.25 young in each of eight litters, only one death occurred during weaning. Moreover, the average weaning weight of the experimental animals was 23.6 grams at 21 days. The average litter number of the controls was 9.2. Three deaths occurred. Yet, the weaning weights of the smaller litters averaged 19.65 as compared to 23.6 of the experimental animals.

Those familiar with laboratory animal production will confirm that the retention of 12.25 young in eight litters through weaning, with the loss of one animal in the experimental group is an unexpected result. This experiment lends weight to the findings of Schioppa (6) (7) (8).

6. The results of this experiment, if confirmed, will clarify the differences in results obtained by those who experimented with vitamin E (the tocopherols) and wheat germ oil. The statement by early workers that wheat germ oil appears to reveal effects of pituitary influence needs be reexamined. These studies and a number of unpublished observations support the view that unidentified factors in wheat germ oil influence pituitary activity.

CONCLUSIONS

Wheat germ oil, produced by solvent extraction with ethylene dichloride, favorably influences conception, litter size, birth weights, and weaning weights of rats, when wheat germ oil was substituted for corn oil and equivalent tocopherol content of wheat germ oil, in a basal diet including casein, wheat germ, liver and blood, supplemented with adequate fat soluble vitamins.

These results are consistent with reports of livestock breeders for more than 15 years, that wheat germ oil aids cows to conceive, aids dams to wean larger litters and to produce pigs of large individual birth weights and weaning weights.

Unidentified fat soluble factors found in wheat germ oil are postulated. These factors influence reproduction, conception, birth weight, litter size, weaning weight, and survival.

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7. Schioppa, Luiga; Zeitschrift fur Vitaminforschung *4*, 162 (1935)
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HISTORY OF THETA CHAPTER OF OHIO, PHI BETA KAPPA

APPENDUM V. (1937–1950)[1]

In April, 1937, in Vol. XXXII, the *Journal of The Scientific Laboratories*, Denison University, published the HISTORY OF THETA CHAPTER OF OHIO, PHI BETA KAPPA, as written by Dr. Willis A. Chamberlin, Chapter Historian. The article covered the history of the chapter from 1911 to 1936. This appendum continues the chapter history to June of 1950.

I. PHI BETA KAPPA ADDRESSES GIVEN AT DENISON UNIVERSITY, 1937–1950

March 24, 1937

Dr. Henry Nobel MacCracken, President of Vassar College

March 23, 1938

Dr. Gordon K. Chalmers, President of Kenyon College
First Steps in Imagination

March 22, 1939

Dr. Donald H. Menzel, Associate Professor of Astrophysics, Harvard University
The Future of Science

March 27, 1940

Dr. John Kirkland Clark, Phi Beta Kappa Senator
Let Freedom Ring

April 23, 1941

Dr. Rollo Walter Brown, Lecturer and Writer
The Romance of Being a Student

March 9, 1942

Dr. Francis P. Gaines, President of Washington and Lee University
Toward a Personal Philosophy

March 17, 1943

Dr. Carter Davidson, President of Knox College
Seven Lovely Virtues Go To War

March 9, 1944

Dr. Howard Bonar Jefferson, President of Clark University
Some Adventures of an Idea

March 12, 1945

Dr. John W. Nason, President of Swarthmore College
A Revolutionary Credo

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[1] By Dr. Willis A. Chamberlin, Chapter Historian.

March 4, 1946

Dr. William Gear Spencer, President of Franklin College
Heresies and Freedoms

March 17, 1947

The Honorable Murray Seasongood, Lecturer, Cincinnati
Is Local Government Worthwhile?

March 15, 1948

Dr. Howard Lowry, President of the College of Wooster
The Paradox of Learning

March 21, 1949

Dr. Arthur S. Flemming, President of Ohio Wesleyan University
Modern Trends in Politics

March 21, 1950

Dr. Clarence C. Stoughton, President of Wittenberg College
The Best

II. OFFICERS OF THETA CHAPTER, 1937–1950.

President

Dr. Frank J. Wright	1935–1938
Professor Karl H. Eschman	1938–1940
Professor August Odebrecht	1940–1941
Dr. Joseph L. King	1941–1943
Dr. W. Alfred Everhart	1943–1945
Mr. Donald R. Fitch	1945–1947
Dr. Graydon S. DeLand	1947–1948
Professor Richard H. Howe	1948–1950
Dr. Maylon H. Hepp	1950–

Vice-President

Dean Helen Olney	1935–1938
Dr. Charlotte Rice	1938–1939
Professor Richard H. Howe	1939–1941
Professor F. Dewey Amner	1941–1943
Mr. Donald R. Fitch	1943–1945
Mr. Alfred J. Johnson	1945–1946
Dr. Graydon S. DeLand	1946–1947
Dr. Morton B. Stratton	1947–1948
Dr. Maylon H. Hepp	1948–1950
Miss Mary K. Selby	1950–

Secretary-Treasurer

Dr. W. Alfred Everhart	1930–1943*
Dr. Walter T. Secor	1943–

Historian

Dr. Willis A. Chamberlin	1932–

* Mr. Donald R. Fitch, assistant during leave of absence, Semester 2, 1940.

III. MEMBERS OF THETA OF OHIO, PHI BETA KAPPA, 1937–1950

Class of 1938

Charles Robert Deeter, *elected in 1937*
William D. Lewis, *elected in 1937*
Esther Goldie Smith, *elected in 1937*
Reid Anderson
Margaret V. Brizell (Mrs. Harry Sweitzer)
Elinor Rose Eschman (Mrs. Harold Dunham)
Phyllis Ann Herzberg (Mrs. George McCuskey)
Helen K. Jones (Mrs. W. S. Breon)
Martha E. Jump (Mrs. Jack Morgan)
Evelyn B. Murton (Mrs. James Morris)
Eleanor F. Osborn (Mrs. David Jasper)
Gail M. Oxley
Elizabeth K. Plum (Mrs. Franklin Brink)
Susie Lee Shelton (Mrs. George Shawkey)
John Gudert Turnbull
David Frank Turner
Leonard G. Wells
Valeria E. Wells (Mrs. Charles Burris)
Charles Franklin Wood

Class of 1939

Florence Esther Price, *elected in 1938*
Ida Jeanne Dagger (Mrs. Stuart Abraham), *elected in 1938*
Harry George Clement, *elected in 1938*
Donald Lough Everhart, *elected in 1938*
Thomas Fulcher Bates
Nelle L. Bumer (Mrs. Richard Baird)
Paul Richard Cosway
John Scott Fulcher
Eileen Alice Meacham (Mrs. Sheldon Keinath)
Tracy Minard Patrick
John William Reed
Kenneth Brookfield Sperl
Bill Covode West

Class of 1940

Virginia Lucile Jones (Mrs. Sherman Neuchel), *elected in 1939*
William James Price, *elected in 1939*
Barbara May Eschman (Mrs. Wilfred Rounseville)
Lawrence Wilford Curtis
Jeanne Irene DeBeauclair (Mrs. Kyle)
Charles Lewis Oxley
Jeanne Elizabeth Shaffer (Mrs. Joseph Coffy)
Mary Elizabeth Sherwood (Mrs. Ira M. Price, II)
Robert Edward Wolfe
Robert James Wright

Alumni members elected in 1940

Arthur Charles Baldwin
Esther J. Crooks
William F. Chamberlin
Lewis Wilbur Smith
Wallace St. John

Class of 1941

Reid Allen Bryson, *elected in 1940*
William Edward Deeds, *elected in 1940*
Lillian R. Grimm, *elected in 1940*
Stanley Sweet Hanna, *elected in 1940*
Jane Reeves Martin (Mrs. Stanley Hanna), *elected in 1940*
Thomas Edmiston Norpell, *elected in 1940*
Marcia Elizabeth Sipple (Mrs. John Neubert), *elected in 1940*
John Alden Innis
Susan Hirschler Haury
Michael Kozak Hubona
Phyllis Elaine Huffman
Karl Otto Klomann
Robert Charles Macomber
Ira Maurice Price, II
Mary Louis Ryan (Mrs. J. Cuthbert Austin)
Mary Ernestine Smith (Mrs. Clark Fouts)
Phyllis Grose Stacy (Mrs. John Irwin)

Class of 1942

Robert Reid Baumgartner, *elected in 1941*
Earl Raymond Haynes, *elected in 1941*
Margaret Anne Collins, (Mrs. John Collison)
Rita Patricia Dayhoff (Mrs. John Schroeder)
George Raymond Hudson
Anna Elizabeth Kreider (Mrs. Richard Phillips)
Barbara J. Love (Mrs. Warren Cash)
Robert Loren Morlan
Alison Phillips (Mrs. Howard Hamilton)
Wilma Louis Shively (Mrs. Back)
Marjorie E. Smith (Mrs. Richard Arden)
Mary E. Todhunter (Mrs. Robert Hanna, Jr.)
Mary Alice Willett

Class of 1943

Warren Lewis Howell, *elected in 1942*
Mary Susan Martz (Mrs. Ross Randolph), *elected in 1942*
Aimee Louis Stuart (Mrs. R. E. Lowey Jr.), *elected in 1942*
Walter Elmer Close
Ellen Elizabeth DeBary (Mrs. Richard Turner)
Roberta Pauline Johnson (Mrs. Robert Grimm)
John Martin Kinney
Marilyn Mae Koons (Mrs. Dan Cartwright, Jr.)
Thelma Elizabeth McKell
Wilhelm Moll
Oliver Henry Welf
Lindsey Elizabeth Yoxall (Mrs. Pietzak)

Class of 1944

Charlotte Gladys Swain, *elected in 1943*
Thelma Elizabeth Willett, *elected in 1943*
Virginia Mae Benson (Mrs. Nichols)
Muriel Cullis (Mrs. Robert Back)
Nancy Elizabeth Forsberg
Dorothy Jean Kerr
Norma Ruth Naab (Mrs. Philip Mann)
Henrietta Estelle Rosenfield
Robert Warren Spike
Forbes B. Wiley, Honorary

Class of 1945

Virginia Lou Stubbs (Mrs. James Parker), *elected in 1944*
Laura Lee Cowen (Mrs. Norman McGregor)
Mary Norman Dagger
Catherine Kuehner (Mrs. Howard Wehr)
Kathleen Parker
Marjorie Spengler (Mrs. William Lumm)
Dorothy Spoerl (Mrs. Henck)
Fred Wright

Alumni members elected in 1945

George B. Cressey
William E. Forsythe
Arthur Wickenden

Class of 1946

Joyce Clarke, *elected in 1945*
Jean Galloway (Mrs. Paul Sauer), *elected in 1945*
Betty Jane Oestmann, *elected in 1945*
Mary Jane Oestmann, *elected in 1945*
Jeanne Vail (Mrs. Lewis Chamberlin, Jr.), *elected in 1945*
Leah Ashbrook
Patricia Hudson (Mrs. Dale C. DeButts)
Martha Klemm (Mrs. Arthur Simpson)

Class of 1947

Ruth Miesse, *elected in 1946*
Martha Sturm, *elected in 1946*
Marcia Wood, *elected in 1946*
Norman Abell
James Ashbrook
Suzanne Barth (Mrs. Robert Browning)
Jean Brokaw (Mrs. Norman Abell)
Margaret Chuck (Mrs. Charles Blessed)
Richard Dean
Jeanne DeGarmo (Mrs. John B. Brown)
Anne Lewis
Constance Palmer (Mrs. Donald Winchell)
John Saveson
James Turner
Roberta Westcott (Mrs. William Maxwell)
Virginia Wetmore
Marcia Voth (Mrs. Gerald Neff)

Class of 1948

Helen Carpenter, *elected in 1947*
Joan Berner
Richard Einwalter
William W. Johnson, (University of Kansas)
Kennedy Legler
Mary Ellen McIntosh
Mary Jane Paul (Mrs. John David Broadhurst)
Dexter Tight
Ann Wagoner
Chester Whitt

Class of 1949

Jack Bertsch, *elected in 1948*
William Connor
Philip Converse
J. William Henderson
Richard Janson
Martha Jones
Russell Karl
Helen E. Kavan
Marjorie Lane
Helen Chase Meyer
Marjorie Nevin
Marian Ruth Peirce (Mrs. Rowland Todd)
Kendall Reynolds
Phyllis Ann Rickey
Leo Stornelli

Elizabeth Summerhays
Kenneth A. Telford

Class of 1950

Nancy Lee Echols, *elected in 1949*
Edward Voss, *elected in 1949*
Phyllis Campbell
David B. Fischbach
L. James Gordon, Jr.
Mary Louise Harvey
Harriet Hawes
James B. Lindberg
Robert L. Phillips
Luther W. Smith, Jr.
Phyllis Wyman

Class of 1951

Jeanne Faye, *elected in 1950*
Mary Langan, *elected in 1950*
James Toy, *elected in 1950*

THE DENISON SCIENTIFIC ASSOCIATION

A REPORT, SUBMITTED IN MAY 1950 BUT PUBLISHED UNDER EARLIER DATE

During the academic year 1949–1950 the program of the Denison Scientific Association was planned and carried out under the direction of the President, Dr. Conrad E. Ronneberg. Miss Dorothy Carpenter, Secretary, has reported the following facts concerning the meetings held. Except as indicated these were held on the basis of open invitation. Average attendance, exclusive of that at the memorial science lecture on April 13, 1950, was about 43 persons.

October 11, 1949

THE BIOLOGICAL FOUNDATIONS OF HUMAN SOCIETY. By Dr. Arthur W. Lindsey, Professor of Biological Sciences

October 25, 1949

SOME ETHNOLOGICAL AND GEOLOGICAL FEATURES OF THE SOUTHERN ROCKY MOUNTAINS. Illustrated with kodachrome slides. By Dr. Harry V. Truman, Assistant Professor of Biological Sciences

November 8, 1949

NUCLEAR ENERGY. Illustrated with film strips of the Oak Ridge plant and of the Bikini bomb experiments. By Dr. R. J. Stephenson, Professor of Physics, The College of Wooster

November 22, 1949

RELATIONSHIP BETWEEN PHYSIQUE TYPES AND HEIGHT, WEIGHT AND STRENGTH SCORES. A report of a study of some 144 Denison women students, illustrated by slides, both graphic and photographic. By Miss Helen A. Barr, Professor of Physical Education, and Miss Sara L. Houston, Assistant Professor of Physical Education

December 13, 1949

SCIENCE IN A LIBERAL EDUCATION. By Dr. Alfred B. Garrett, Professor of Chemistry, The Ohio State University

January 10, 1950

THE PROBLEM OF ANXIETY. A lecture relative to laboratory experiments on the measurement of anxiety in dogs. By Dr. Parker E. Lichtenstein, Associate Professor of Psychology

February 14, 1950

A Closed Meeting. Discussions of 1) general plans for the first annual science lecture, 2) science emphases in the Denison curriculum

February 28, 1950

No Meeting. The meeting was cancelled in order to permit members to attend the open lecture at The Ohio State University in Columbus, Ohio, by Dr. Harold C. Urey, Nobel prize winner

March 14, 1950

THE ELECTRET. By Dr. Leon E. Smith, Professor of Physics

March 28, 1950

A Closed Meeting. Discussions of 1) final plans for the memorial science lecture to be given by Dr. Charles Glen King, in April, and 2) the training of high school science teachers

April 13, 1950

FOOD, AGRICULTURE AND HEALTH. By Dr. Charles Glen King, Professor of Chemistry at Columbia University, Scientific Director of the Nutrition Foundation, Inc., and a Trustee of Denison University

This lecture was presented as the *Clarence Luther Herrick Memorial Science Lecture* to an audience of about four hundred, including many off-campus guests, in Swasey Chapel. Preceding the lecture Dr. A. W. Lindsey spoke briefly concerning the life and work of a former Denison professor, Dr. Clarence Luther Herrick, paying tribute to his exceptional accomplishments as a geologist, taxonomist, philosopher, teacher, and a pioneer in the study of neurology. He quoted, also, a letter of appreciation from his distinguished brother and colleague, Dr. C. Judson Herrick.

April 25, 1950

SENIOR PROJECTS. A series of reports by Denison Seniors on certain honors and other special projects being currently pursued.

A Study of Three Theoretical Distribution Functions, by Jean Mather

Generalized Coordinate Systems, by Harvey W. Preslan

Methods of Standardizing Hydrochloric Acid, by John A. Frane

A Survey of Counting Methods of Radioactive Radiations, by David B. Fischbach and Robert D. Smith

May 8, 1950

Annual Dinner Meeting. This was held at the Colwell Dining Hall, followed by a final business session in the Shaw Hall recreation rooms. There were the usual reports of 1) the secretary-treasurer, 2) the editor of the *Journal of the Scientific Laboratories*, 3) a committee on student counselling for science courses, 4) a nominating committee.

Elections resulted in the appointment of the following list of officers for the academic year 1950–1951.

President	Dr. Harry V. Truman
Vice-president	Mr. Samuel C. Wheeler
Secretary-Treasurer	Miss Dorothy Carpenter
Librarian	Dr. Leon E. Smith
Editor and Secretary, *Journal of the Scientific Laboratories*	Dr. W. Alfred Everhart
Assistant Secretary	Mr. Cecil R. Fetters
Committee on Honorary Degrees	Dr. Arthur W. Lindsey, 3 years
	Dr. Parker E. Lichtenstein, 2 years
	Dr. Leon E. Smith, 1 year

Due to circumstances beyond control it was found necessary to omit publication of a December 1949 number of the *Journal of the Scientific Laboratories.* Separate copies of title pages, table of contents and index sheets for Volume 41 (1948–1949) are supplied with this (April 1950) number of the Journal.

Report by
W. A. EVERHART, Editor.

New Species of Bryozoans from the Pennsylvanian of Texas; Raymond C. Moore. 17 pp., 1 plate.

Articles 4–5, pp. 165–200, August, 1930.....$1.00
Visual Localization in the Horizontal Plane; Winford L. Sharp. 9 pp.
Petroleum Products for Internal Combustion Engines; Milton Finley. 26 pp., 3 figs.

Articles 6–7, pp. 201–299, December, 1930.....$1.00
The Actinoceroids of East-Central North America; Aug. F. Foerste and Curt Teichert. 96 pp., 33 plates.
The Presence of Nybyoceras in South Manchuria; Riuji Endo. 3 pp., 1 plate.

VOLUME 26

Article 1, pp. 1–142; April, 1931.....$1.50
The Hesperioidea of North America; A. W. Lindsey, E. L. Bell and R. C. Williams, Jr. 142 pp., 33 plates.

Article 2, pp. 143–250; December, 1931.....$1.50
The Older Appalachians of the South; Frank J. Wright. 108 pp., 38 plates.

VOLUME 27

Article 1, pp. 1–46; June, 1932.....$1.50
The Geomorphic Development of Central Ohio (Part I); Henry S. Sharp. 46 pp., 1 fig., 6 plates.

Article 2, pp. 47–136; December, 1932.....$1.50
Black River and Other Cephalopods from Minnesota, Wisconsin, Michigan, and Ontario (Part I); Aug. F. Foerste. 90 pp., 31 plates.

VOLUME 28

Articles 1–3, pp. 1–154; April, 1933.....$1.50
Black River and Other Cephalopods from Minnesota, Wisconsin, Michigan, and Ontario (Part II); Aug. F. Foerste. 146 pp.; for plates *cf.* This Journal, Vol. 27, Art. 2 (December, 1932).
A Study of the Change in Mass of the Anode of the Aluminum-Lead Cell; Charles E. Welling. 5 pp.
Balancing Chemical Equations—The Contribution of Otis Coe Johnson (1880); W. C. Ebaugh. 4 pp., 1 plate.

Article 4, pp. 155–248; October, 1933.....$1.00
The Ordos Desert of Inner Mongolia; George B. Cressey. 94 pp., 32 figs., 1 plate.

VOLUME 29

Article 1, pp. 1–105, April, 1934.....$1.25
The Newer Appalachians of the South (Part I); Frank J. Wright. 105 pp., 28 plates, 3 figs.

Article 2, pp. 107–193, August, 1934.....$1.25
Silurian Cyrtoconic Cephalopods from Ohio, Ontario, and Other Areas; Aug. F. Foerste. 86 pp., 14 plates.

Articles 3–4, pp. 195–238, December, 1934.....$1.00
Evidence of Ice Action in the Teays Valley, West Virginia; Julian J. Petty. 10 pp., 4 figs.
The Earlier History of the BULLETIN OF THE SCIENTIFIC LABORATORIES OF DENISON UNIVERSITY; Aug. F. Foerste. 23 pp.

VOLUME 30

Articles 1–2, pp. 1–118, April, 1935.....$1.00
Big Horn and Related Cephalopods; Aug. F. Foerste. 96 pp., 22 plates.
New Light Sources for Photographic Purposes; W. E. Forsythe. 22 pp., 7 figs.

Articles 3–4, pp. 119–230, August, 1935.....$1.00
Correlation of Silurian Formations in Southwestern Ohio, Southeastern Indiana, Kentucky and Western Tennessee; Aug. F. Foerste. 87 pp.
A Study of the Phenomenon of Wetting Films; C. W. Chamberlain and Kenneth Lyle Warren. 25 pp., 4 plates, 1 fig.

Articles 5–6, pp. 231–303, December, 1935.....$1.00
The Cephalopods of the Maquoketa Shale of Iowa; Aug. F. Foerste. 27 pp., 11 plates.
New Genera of Ozarkian and Canadian Cephalopods E. O. Ulrich and Aug. F. Foerste. 32 pp., 1 plate.

VOLUME 31

Articles 1–2, pp. 1–92, April, 1936.....$1.00
Hierosaurus colei; a new aquatic Dinosaur from the Niobrara Cretaceous of Kansas; M. G. Mehl. 20 pp., 3 plates.
Silurian Cephalopods of the Port Daniel Area on Gaspé Peninsula, in Eastern Canada; Aug. F. Foerste. 72 pp., 23 plates.

Article 3, pp. 93–142, August, 1936.....$1.00
The Newer Appalachians of the South (Part II): South of the New River; Frank J. Wright. 50 pp., 6 figs., 32 plates.

Articles 4–6, pp. 143–259, December, 1936.....$1.00
A Study of the Vestigial Air Bladder in the Darter (*Catonotis flabellaris rafinesque*); George David Morgan. 16 pp., 10 plates.
e Must Shape our New World (Commencement Address); Arthur Holly Compton. 11 pp.
Later History of the JOURNAL OF THE SCIENTIFIC LABORATORIES OF DENISON UNIVERSITY; Kirtley F. Mather. 25 pp.
Report of the Permanent Secretary of the DENISON SCIENTIFIC ASSOCIATION. 52 pp.

VOLUME 32

Articles 1–2, pp. 1–131, April, 1937.....$1.00
History of *Theta* Chapter of Ohio, Phi Beta Kappa (1911–1936); Willis A. Chamberlin. 69 pp., 2 figs.
The Tungsten Filament Incandescent Lamp; W. E. Forsythe and E. Q. Adams. 72 pp., 10 figs.

Articles 3–7, pp. 133–207, August, 1937.....$1.00
Science and the College (Commemoration Address); Carey Croneis. 12 pp.
Our Endowment (Commemoration Address); C. Judson Herrick. 9 pp.
Science—Man's Liberator (Commemoration Address); William E. Wickenden. 10 pp.
The Application of Physics to Modern Hydrographic Surveying; (Commemoration Address); Herbert Grove Dorsey. 22 pp., 10 plates.
An Annoted Check-list of Birds Recorded at Granville, Licking County, Ohio; Ward M. Klepfer and William J. Taylor. 21 pp., 1 plate.

Article 8, pp. 209–337, December, 1937.....$1.00
Upper Carboniferous Crinoids from the Morrow Subseries of Arkansas, Oklahoma and Texas; Raymond C. Moore and Frederick N. Plummer. 106 pp., 37 figs. 5 plates.
Report of the Permanent Secretary of the DENISON SCIENTIFIC ASSOCIATION. 10 pp.

VOLUME 33

Article 1, pp. 1–60, April, 1938.....$1.00
The Telescopic Alidade and the Plane Table as used in Topographic and Geologic Surveys; Kirtley F. Mather and Bradford Washburn. 60 pp., 19 figs.

Articles 2–3, pp. 61–155, August, 1938.....$1.00
Chemistry and the Modern Meat Packing Industry; Minard Patrick. 48 pp., 3 figs.
Certain Nuclear Masses in the Macaque Medulla Oblongata—Preliminary Report; Frederick David Goudie. 47 pp., 8 figs.

Articles 4–7, pp. 157–369, December, 1938.....$1.50
The Use of Fragmentary Crinoidal Remains in Stratigraphic Paleontology; Raymond C. Moore. 86 pp., 14 figs., 4 plates.
New Ostracodes from the Golconda Formation; Carey Croneis and Arthur S. Gale, Jr. 46 pp., 2 plates.
New Ostracodes from the Kinkaid Formation; Carey Croneis and Franklin A. Thurman. 34 pp., 2 plates.
New Ostracodes from the Clore Formation, Carey Croneis and Harold J. Funkhouser. 29 pp., 2 plates.
Report of the Permanent Secretary of the DENISON SCIENTIFIC ASSOCIATION. 8 pp.

VOLUME 34

Articles 1–3, pp. 1–63, April, 1939.....$1.00
Some Factors Affecting the Operation of Incandescent Lamps; W. E. Forsythe, E. Q. Adams, and P. D. Cargill. 27 pp., 7 figs.
Taxonomy of Chester Ostracodes; Carey Croneis. 4 pp.
New Ostracodes from the Renault Formation; Carey Croneis and Ralph L. Gutke. 31 pp., 2 plates.

Articles 4–5, pp. 65–169, August, 1939.....$1.00
New Ostracodes from the Menard Formation; Carey Croneis and Hubert M. Bristol. 38 pp., 2 plates.
Pioneering in Yeneseiland. A transect across Siberia from Mongolia to the Arctic; George B. Cressey. 67 pp., 51 figs.

Article 6, pp. 171–294, December, 1939.....$1.00
New Crinoids from Upper Pennsylvanian and Lower Permian Rocks of Oklahoma, Kansas, and Nebraska; Raymond C. Moore. 109 pp., 39 figs., 5 plates.
Report of the Permanent Secretary of the DENISON SCIENTIFIC ASSOCIATION. 8 pp.

VOLUME 35

Articles 1–2, pp. 1–54, April, 1940.....$1.00
The Relative Efficiency of Single Versus Multiple Ex-

posures in the Rapid Memorization of Visual Form; L. C. Steckle. 31 pp., 7 figs.
New Genera of Pennsylvanian Crinoids from Kansas, Oklahoma and Texas; Raymond C. Moore. 23 pp., 9 figs., 1 plate.
Article 3, pp. 55–137, August, 1940.....$1.00
Relationships of the Family Allagecrinidae, with Description of New Species from Pennsylvanian Rocks of Oklahoma and Missouri; Raymond C. Moore. 83 pp., 14 figs., 2 plates.
Articles 4–8, pp. 139–218, December, 1940.....$1.00
Gas Amplification of Photo-electric Currents for High Values of *E/P*; Neil Edward Handel. 28 pp., 15 figs., 1 plate.
Caney Conodonts of Upper Mississippian Age; E. B. Branson and M. G. Mehl. 12 pp., 1 plate.
Conodonts from the Keokuk Formation; E. B. Branson and M. G. Mehl. 10 pp., 1 plate.
A Record of Typical American Conodont Genera in Various Parts of Europe; E. B. Branson and M. G. Mehl. 6 pp., 1 plate.
The Recognition and Interpretation of Mixed Conodont Faunas; E. B. Branson and M. G. Mehl. 15 pp.
Report of the Permanent Secretary of the DENISON SCIENTIFIC ASSOCIATION. 8 pp.

VOLUME 36

Articles 1–3, pp. 1–66, April, 1941.....$1.00
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